Network Starter Kit Workshop

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For

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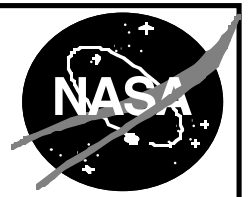
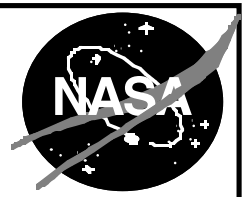


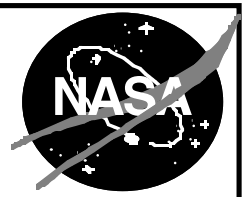
Objectives of the Presentation

- Inform individuals responsible for implementing and enhancing Local Area Networks (LANs)
- How to plan, design and implement a low cost LAN, focusing primarily on 10Base-T technologies
- Discuss some common problems and troubleshooting techniques



Contents

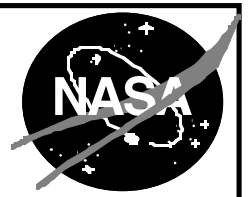
- Overview of the Network Starter Kit (NSK)
- Equipment that can be Networked
- Networking Components
- Network Planning
- LAN Installation Procedures
- Internet Hook-up Procedures
- Network Trouble-Shooting Techniques



Overview of the NSK

Why was the NSK Created?

- To provide simple step-by-step instructions for LAN installation with little presumed knowledge required.
- To distribute free and public domain network software to schools and universities.
- To document hardware and software installation procedures
  - Graphical Examples
  - Text Examples



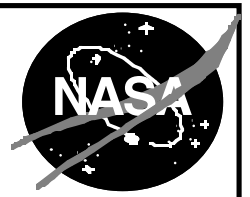
Overview of the NSK

- **To detail basic LAN setup**
  - **Network Terminology**
  - **Network Planning**
  - **Network Topologies**
- **To discuss Internet connectivity**

Overview of the NSK

Limitations of the NSK

- **Network**
  - **Number of stations: less than a hundred**
- **Operating Systems**
  - **PC's: Running MS-DOS 3.3 or later version, or running Microsoft Windows 3.0 or later version.**
  - **Mac's: Running System 6 or later version**
- **Network Software (limited to TCP/IP)**
  - **TCP/IP Software**
    - » **telnet**
    - » **ftp**



Overview of the NSK

- » Electronic mail (client)
- » World Wide Web Browsers
- » Usenet News Readers

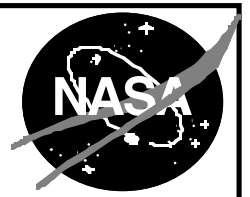
– Packet Drivers

- » PC DOS
- » PC Windows
- » Mac

Overview of the NSK

Network Terminology

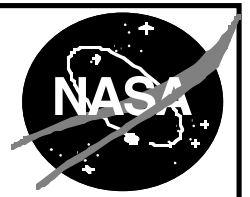
- **Network Interface Unit/Card (NIU/NIC)**
  - **A board or card inserted in a computer to enable it to access a network**
- **Hub**
  - **The center of the Star Topology**
- **UTP Cable**
  - **An 4-wire twisted pair cable with telephone jack-like connectors used to connect a 10Base-T NIU or wall plate to an Active Hub. Level 5 recommended.**



Overview of the NSK

Network Terminology

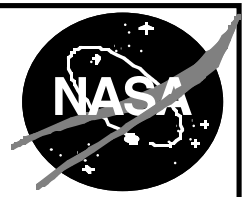
- **Station (Workstation)**
  - **A PC, Mac or any computer on the network**
- **Server**
  - **A network station capable of performing special services such as remote login, file sharing, electronic mail, remote printing, etc., to all stations on the local network**
- **Bus**
  - **A network topology in which a common communication medium is shared by all stations**



Overview of the NSK

Network Terminology

- **Ethernet**
  - **A local area network using Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Protocol to ensure Data Units known as Packets are transmitted and received among stations on the bus**
- **Trunk Cable**
  - **The main cable used as a bus which all stations use to communicate on the LAN**

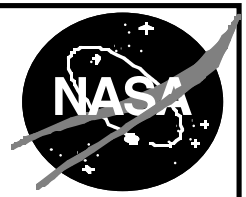


Equipment That Can Be Networked

- **Mainframes, Minicomputers, Workstations**
  - **PC**
    - » **PC's, XT's, AT's**
  - **Bus Family**
    - » **ISA: 286, 386, 486, 586**
    - » **VESA: 486, 586**
    - » **PCI: 486, 586**
    - » **EISA: 386/486 Systems**
    - » **MCA: PS/2**
- **Personal Home Computers**
  - **Connected through a modem**
  - **May use PPP or SLIP for direct Internet connection**

Equipment That Can Be Networked

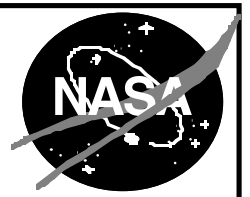
- Mac's
  - » II, LC, SE, SE/30
  - » Mac Plus, Classic
  - » Quadra 700,900,950
  - » Power PC



Network Components

Networking Hardware

- **Unshielded Twisted Pair (UTP) Ethernet**
  - 10Base-T Active Hub
  - Unshielded Twisted Pair Cable
  - 10Base-T Connector (RJ45)
  - NIU with modular Jack
- **Thick Ethernet**
  - Attachment Unit Interface (AUI or transceiver) cable
  - Coaxial cable segment and terminators
  - NIU
  - Transceiver



Network Components

Networking Hardware

- **Thin Ethernet**
  - Thin ethernet coaxial cable (with T-connectors)
  - Terminators with BNC connectors
  - NIU with 10Base-5 Connector
- **Media Adapters**
  - Available for 10Base-5, 10Base-2 and 10Base-T
- **Bridges**
  - Connect two or more physical networks
- **Routers**
  - Connect different network/media types (LAN, WAN, MAN)
  - Used to further subdivide larger networks
  - Create firewalls for security porpoises

Network Components

Networking Hardware

- **Media Limitations**

Medium	Max Length	Minimum Distance Between Stations	Maximum Number of Nodes	AUI Cable
10 BASE-5	500 meters	2.5 meters	100	50 meters
10 BASE-2	185 meters	1 meter	30	none
10 BASE-T	100 meters	N/A (Hub)	8 to 64	100 meters

Networking Components

Networking Software

(Provided in the NSK)

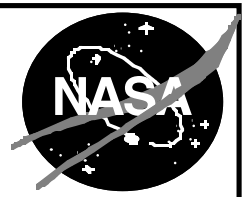
- **PC**
  - **Packet Drivers, V10**
  - **TCP/IP Software, NCSA Telnet, V2.3**
  - **E-mail**
- **Windows**
  - **Windows Packet Driver**
  - **TCP/IP Protocol Stack**
  - **E-mail**
  - **Web Browser**
  - **Usenet News Reader**

Networking Components

Networking Software

- Telnet and FTP

- **Macintosh**
  - MacTCP Driver
  - Telnet and FTP
  - De-Compression Software
  - E-mail



Networking Components

Software Functions

- **Packet Drivers**
  - **Provide a common interface for applications to access the network hardware**
- **Telnet and FTP**
  - **Provide remote login functions**
  - **Enable file transfers between different machines**
- **E-mail**
  - **A convenient method of communication between individuals across the Internet**

Networking Components

- **Web Browsers**
  - **A very intuitive way to access the resources of the Internet**
  - **May include text, graphics, sound, movies**
- **Usenet News Readers**
  - **Access to discussion groups on over 3000 topics**

Network Planning

Requirements

- **Environmental Considerations**
  - Fire Codes
  - Power Surges
  - Water and Heat
  - Safety and Security
- **Network Topology**
  - Bus
  - Star
  - Ring

Network Planning

- **Network Extension**
  - **Bridges**
  - **Routers**
  - **Repeaters**
- **Network Cables**
  - **Twisted Pair**
  - **Thick Coax**
  - **Thin Coax**

Future Expansion

- **Linking Different LAN media and topologies**
- **Linking Remote Sites**
- **Evolve to High Speed networks in the future**

Network Planning

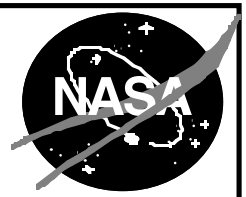
Site Selection

- **Avoid Electro-Magnetic Interference (EMI) such as neighboring cable interference**
- **Location of the hubs**

Network Planning

Budget and Options

- **Network Management Consideration**
  - **Purchase equipment with a built-in SNMP Agent**
- **Cable Costs**
  - **Thick Ethernet Coax PVC $1.65/ft**
  - **Thin Ethernet Coax PVC $.15/ft**
  - **Twisted Pair level 5 $.24/ft or less**



Network Planning

Guidelines

- **Use 10Base-T Ethernet**
  - **Low-cost cables, spare telco line may be ok**
  - **Active hub, a Mixed Media concentrator for:**
    - » **10Base-5**
    - » **10Base-2**
    - » **10Base-T**
- **Avoid complicated designs**
- **Avoid using repeaters to extend the network**
- **Use components from the same vendor if possible**

LAN Installation Procedures

A 10Base-T LAN (why?)

- **Easy and Cheap to Manage/Install**
  - Workstations are connected to a Port in a Hub
  - Individual Ports can be monitored and controlled remotely
  - If a wire goes bad, only one workstation is impacted
  - Most have port monitor LED's for troubleshooting
- **10Base-T Physical Interface**
  - Looks like a phone jack
  - Simple to connect/disconnect

LAN Installation Procedures

Hardware Installation

- **Prepare Cable**
  - Strip the UTP cable to expose the two pairs
  - Insert stripped end into an RJ45 Modular Jack
  - Insert the Jack into the socket slot on the crimp tool, and press hard to crimp the wire
- **Configure the NIU**
  - Set Jumpers & Dip-Switch Setting
    - » Select hardware interrupt
    - » Select the base input/output (I/O) & shared RAM addresses

LAN Installation Procedures

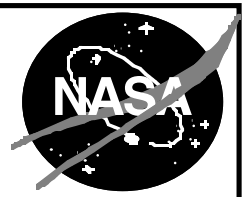
Hardware Installation

- Record Jumper and Dip-switch settings
- Install the NIU into an available Expansion Slot
- Connect the NIU to a 10Base-T Active Hub
- Connect the Hub to the existing Ethernet Trunk

LAN Installation Procedures

Software

- **Install Packet Drivers (DOS and Windows)**
  - **Select Software interrupt**
  - **Select packet driver for the NIU that you have, either from the NSK selection or from the NIU manufacturer**
  - **Load the driver with appropriate parameters**
  - **Add the command to your autoexec.bat**
- **Install the Windows Packet Shim**
  - **Use the same software interrupt as the DOS driver**
  - **Load the shim**
  - **Add the command to your autoexec.bat**

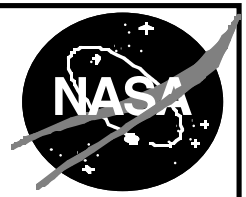


LAN Installation Procedures

- **Install TCP/IP Network Software for DOS**
  - **Get IP name and number from LAN administrator for each station on the network**
  - **Locate and edit the Config.tel file to reflect the network configuration**
  - **Install and configure E-mail**
  - **(optional) Install and configure server software**
- **Install TCP/IP Network Software for Windows**
  - **Get IP name and number from LAN administrator for each station on the network**
  - **Load and configure Winsock to reflect the network configuration**
  - **Install and configure other applications**
  - **(optional) Install and configure server software**

LAN Installation Procedures

- **Install MacTCP for Mac's**
  - **Get IP name and number from LAN administrator for each station on the network**
  - **Configure the MacTCP Control Panel to reflect the network configuration**
  - **Configure individual applications**



Internet Hook-up

- **Equipment Required**
  - **TCP/IP Router**
  - **56Kbps, T1 or T3 leased line**
  - **CSU/DSU**
- **Putting it all Together**
  - **Obtain IP Address Space from Internet authorities**
  - **Hardware Installation**
    - » **Get a 56Kbps (min) dedicated line**
    - » **Connect NIU of the Router to your LAN**

Internet Hook-up

- » Connect the WAN Port of your Router to a Channel Service Unit/Data Service Unit (CSU/DSU)
- » Seek assistance to connect the CSU/DSU to the leased line
- » Configure the Routing software

– Configure all Network Stations

Internet Hook-up

Who Pays the Bill?

- **Write a Grant Proposal to the National Science Foundation**

NSFNet Program

Division of Networking & Communications Research and Infrastructure

4201 Wilson Blvd.

Arlington, VA 22230

(703) 306-1950

Network Troubleshooting Techniques

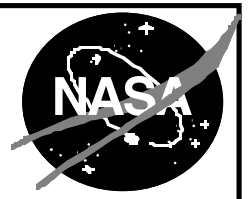
- **Cables**
  - **For 10BaseT (UTP Level 5) Check that connectors are attached to cable and that cable is securely attached to NIU and Hub port.**
  - **For 10Base5 (Thick Coax) Check all connectors and terminators**
  - **Check the Ethernet Trunk, are other devices functional?**
  - **Check Transceiver LED's, usually green indicates power, red indicates collisions, and yellow indicates ethernet activity. If red is on solid, this is a good indication that problems exist with that particular tap. Absence of green or yellow indicates problems with the device attached to transceiver, or the AIU cable is not attached.**
  - **For 10Base2 (Thin Coax) Check connectors and terminators and T-Connectors**

Network Troubleshooting Techniques

- **NIU's/NIC's (power off the system before proceeding)**
  - **Disconnect all Access Cables, Connectors and cables**
  - **Remove the NIU/NIC and check all Dip Switches and Jumpers settings**
  - **Re-install the NIU/NIC and attach cables, etc.**
  - **Check to insure that there are no conflicts with Interrupts, IO Address Base, or Memory Base Addresses with other cards installed in PC**
  - **Run diagnostic software that accompanied your NIU/NIC**

Network Troubleshooting Techniques

- **Hub**
- **Check to ensure that the Hub is properly connected to the Trunk and that "ethernet activity" LED is blinking**
- **Ensure that the Hub powered "on", (green LED)**
- **Ensure that individual ports have power LED, Link LED (indicating that hub sees PC) and Ethernet activity LED's**
- **Move suspected problem cable to another port/card on Hub**
- **Replace Hub**



Network Troubleshooting Techniques

- **Software (DOS)**
  - **Check that Packet Driver is loaded and configured properly**
  - **Check that software was configured properly**
  - **Reload Packet Driver/NOS Software**
  - **Reboot**

Network Troubleshooting Techniques

- **Software (Windows)**
  - **DOS procedure completed?**
  - **Check WINPKT.COM software interrupt settings**
  - **Reload WINPKT**
  - **Check Trumpet and Winsock (reload if necessary)**
  - **Check WIN32S and reload if necessary**
  - **Reboot**

Network Troubleshooting Techniques

- **Software (MAC's)**
  - **Check MAC/TCP to ensure installation is proper**
  - **Check Ethernet Driver**
  - **Re-install MAC/TCP**
  - **Reboot**